

# Flexible Absorbent Material (FAM)

## Features :

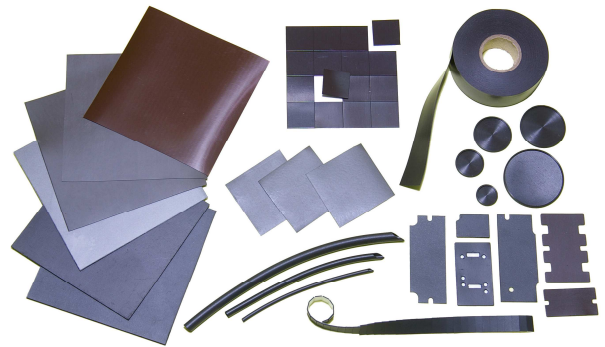
- Provide effective EMI suppression in a wide frequency range (1MHz to 18GHz)
- Change the magnetic flux path to avoid interference other components
- Reduce the eddy current when magnetic flux close metal
- Ultra thin and extremely flexible, can be freely arranged in space
- Non-conductive adhesive backing (UL Recognized) available
- Effective in preventing resonance and suppressing coupling
- High surface resistance ( $10^6$  ohms)
- Easy and fast to process
- Can be cut any shape easily

**RoHS 2.0**  
2011/65/EU

## Applications :

- RFID (Radio Frequency Identification) systems
- RFID Digital Locks / Smart Locks
- NFC (Near field communication)
- Wireless Power Chargers (WPC / Qi)
- Computers (NB / Desktop / Tablet) and peripherals
- Digital Products
- Mobile Phones / Smart Phones / Phablet
- Wireless equipments
- Shielding Box / Dark Box

## Sheet Shape :

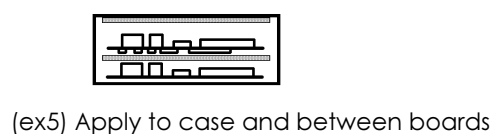
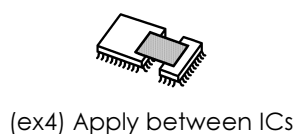
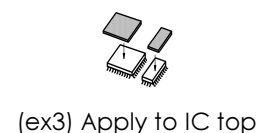
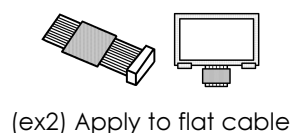
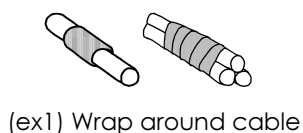


## Tube Shape :



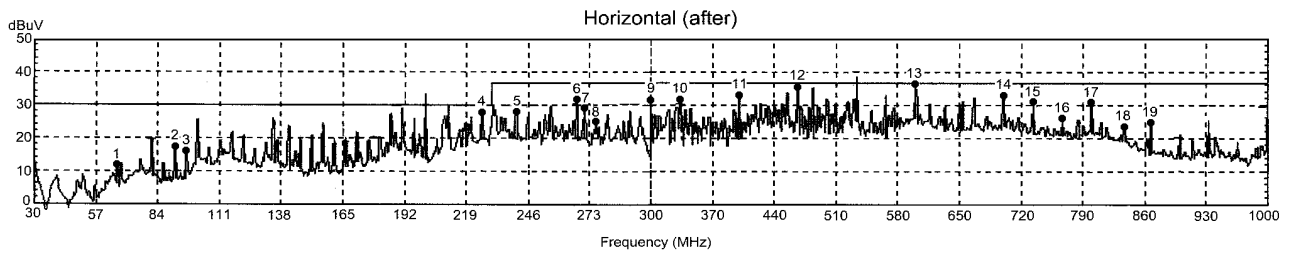
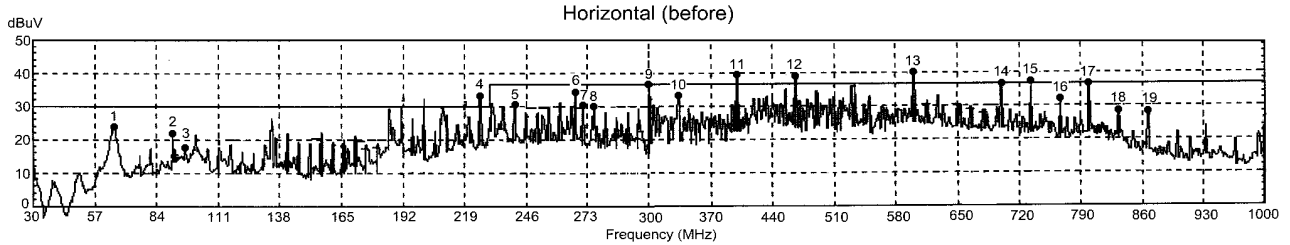
Item	FT0302	FT0504	FT0705	FT0906	FT1107	FT1309	FT1510
OD (mm)	3.0	5.0	7.0	9.0	11.0	13.0	15.0
ID (mm)	2.0	4.0	5.0	6.0	7.0	9.0	10.0

## Usage Examples for EMI :

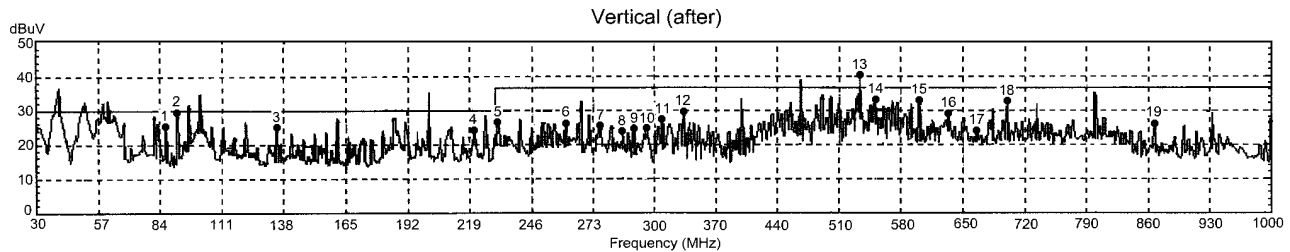
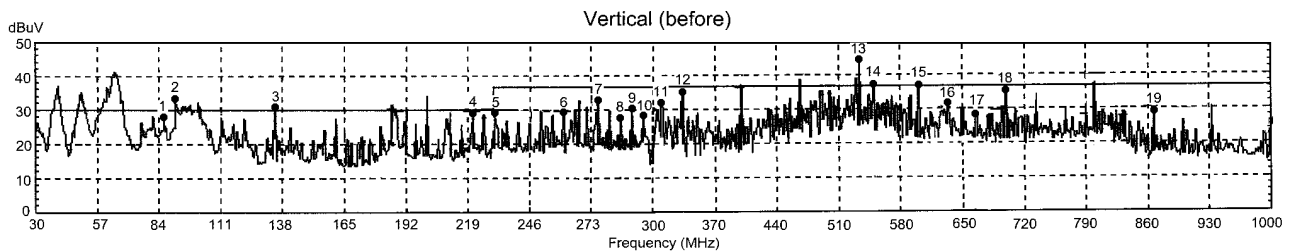


# Flexible Absorbent Material (FAM)

## Test Example for EMI : Notebook + FAM ( before and after )



Horizontal	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Frequency (MHz)	65.1	91.7	96.3	225.6	241.0	267.2	270.7	275.7	300.0	334.0	399.0	466.0	600.0	700.0	733.0	767.0	800.0	833.0	867.0
before (dBuV)	23.8	21.6	18.9	32.7	30.1	33.5	30.2	29.7	36.4	34.3	39.9	38.9	40.2	36.8	37.0	31.6	35.6	27.9	27.6
after (dBuV)	12.0	16.9	15.4	27.1	28.0	31.2	27.5	24.7	31.1	31.2	32.9	36.9	36.6	32.7	30.5	25.9	30.7	23.0	24.6
Attenuation (dBuV)	11.8	4.7	3.5	5.6	2.1	2.3	2.7	5.0	5.3	3.1	7.0	2.0	3.6	4.1	6.5	5.7	4.9	4.9	3.0

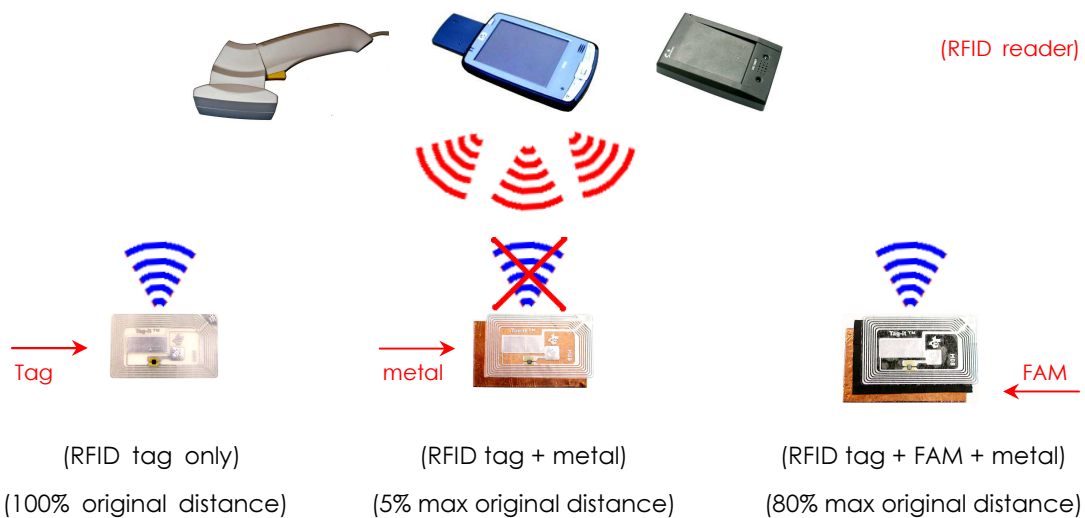


Vertical	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19
Frequency (MHz)	86.7	91.3	134.5	221.3	230.6	261.0	275.3	285.7	290.7	295.4	309.0	333.0	534.0	550.0	633.0	665.0	701.0	709.0	866.0
before (dBuV)	28.0	33.1	30.4	28.2	28.8	28.8	32.3	27.3	30.2	28.4	31.7	34.5	43.8	36.7	36.3	30.9	28.0	34.9	28.7
after (dBuV)	25.1	29.0	24.9	22.8	26.2	25.8	25.3	23.9	25.8	24.7	26.8	29.6	40.6	33.3	32.7	27.8	24.1	32.4	25.9
Attenuation (dBuV)	2.9	4.1	5.5	5.4	2.6	3.0	7.0	3.4	4.4	3.7	4.9	4.9	3.2	3.4	3.6	3.1	3.9	2.5	2.8

# Flexible Absorbent Material (FAM)

## Application for RFID / NFC on metal :

When RFID tag or RFID reader/writer attached on metal (PCB ground / metallized shielding surface / battery), the read distance will become much shorter than expect. The traditional design is to increase the space between RFID antenna and metal but cause the RFID device with a big thickness. FAM can be a solution to improve the read distance for **LF (125/134.2KHz)** and **HF (13.56MHz)** bands. After insert FAM between RFID antenna and metal surface, the read distance can recover maximum 80% efficiency than the original distance with no metal. Due to FAM with small thickness, a slight figure can be designed easily than before.



## Test Example for RFID Read Distance (Reference) :

Tag IC	Tag only	Tag + metal	Tag + <b>FAM1</b> + metal								
			0.2mm	0.25mm	0.33mm	0.5mm	0.6mm	1.0mm	1.5mm	2.0mm	2.5mm
Icode2	102 mm	0 mm	38 mm	40 mm	45 mm	59 mm	70 mm	70 mm	67 mm	64 mm	63 mm
TI 2048	132 mm	0 mm	32 mm	38 mm	48 mm	71 mm	82 mm	60 mm	51 mm	50 mm	49 mm
EM4100	148 mm	25 mm	59 mm	60 mm	82 mm	102 mm	97 mm	55 mm	37 mm	36 mm	35 mm

Tag IC	Tag only	Tag + metal	Tag + <b>FAM3</b> + metal			Tag + <b>FAM6</b> + metal				
			0.25mm	0.50mm	0.75mm	0.05mm	0.1mm	0.2mm	0.3mm	0.5mm
Icode2	102 mm	0 mm	45 mm	59 mm	73 mm	65 mm	64 mm	63 mm	63 mm	59 mm
TI 2048	132 mm	0 mm	35 mm	77 mm	85 mm	59 mm	51 mm	48 mm	48 mm	48 mm
EM4100	148 mm	25 mm	66 mm	100 mm	96 mm	99 mm	43 mm	31 mm	27 mm	25 mm

Tag IC	Tag only	Tag + metal	Tag + <b>FAM7</b> + metal			Tag + <b>FAM6B</b> + metal				
			0.08mm	0.12mm	0.22mm	0.05mm	0.1mm	0.2mm	0.3mm	0.5mm
Icode2	102 mm	0 mm	68 mm	61 mm	61 mm	65 mm	62 mm	62 mm	62 mm	61 mm
TI 2048	132 mm	0 mm	75 mm	59 mm	51 mm	57 mm	48 mm	48 mm	47 mm	46 mm
EM4100	148 mm	25 mm	98 mm	47 mm	35 mm	52 mm	33 mm	30 mm	27 mm	23 mm

- The tag is standard ISO card size with different chips.
- Different reader will cause different read distance.

# Flexible Absorbent Material (FAM)

## FAQ for RFID / NFC applications :

Q1 : Why FAM applicable frequency is GHz but can be used for for LF (125/134.2KHz) and HF (13.56MHz) ?

A1 : FAM is a kind of high electrical resistivity and low magnetic loss material. It works well for suppression near-field electromagnetic coupling effects (RFID/NFC/Wireless Power) because it's power loss is low when frequency is under 10MHz.

Q2 : How RFID / NFC affect by metal?

A2 : The magnetic flux from RFID tag or reader/writer will induce eddy current on metal surface and generate a reverse magnetic field to offset the magnetic flux to cancel the communication.

Q3 : How to use FAM for a LF / HF RFID tag?

A3 : Attach FAM with antenna / inlay tightly and embed into any shape as you need. When the tag attached on metal surface, please use FAM side, not antenna side.

Q4 : How to use FAM for a LF / HF RFID reader/writer?

A4 : Insert FAM between reader's antenna area and circuit board tightly to get a compact design. When use the reader/writer, please don't use antenna side to attach the metal surface.

Q5 : Can I use FAM for a UHF RFID tag?

A5 : FAM is not suitable for UHF RFID tags.

Q6 : How to choose FAM thickness?

A6 : FAM has standard thickness as page 8. You can test different thickness with your RFID device directly to compare which thickness can get the best distance. It's a fast and easy function to evaluate FAM.

Q7 : Why I can't get a good read distance after using FAM?

A7 : When FAM close RFID device, the inductance in LC circuit will increase and the response frequency will become lower. If your tag's frequency is far away reader's frequency, the read range will become shorter than before. In such a case, re-design the antenna to adjust L and C to get a reasonable response frequency will be the best function. (please see page 5)

Q8 : Is there any factors can change RFID tag read range?

A8 : Many diverse factors will cause read range different, for example : operation frequency, reader output power, tag antenna size, reader antenna size, active tag or passive tag, reader position, objects interference, others RF device interference, metal material/size, FAM material/size and etc.

Q9 : What FAM dimension should I use?

A9 : When FAM cover the whole RFID antenna area can get the best performance. (please see page 6)

Q10 : How is the performance if I assemble small piece FAM to cover the whole RFID antenna?

A10 : The performance will the same the whole piece FAM.

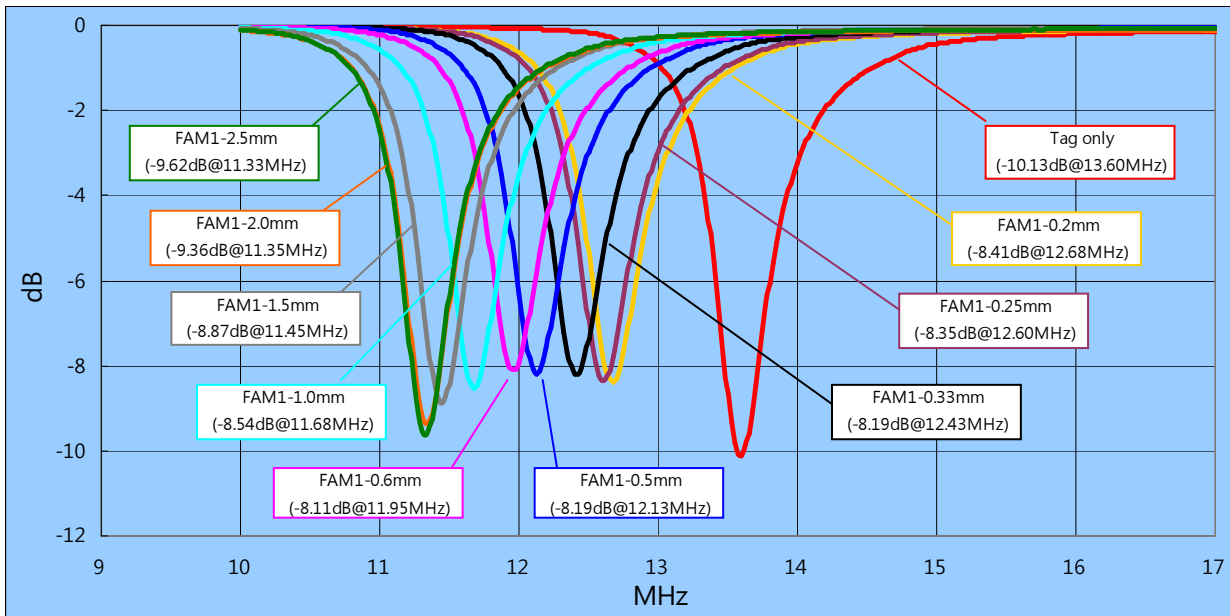
Q11 : Is there any different for FAM two sides?

A11 : FAM include soft rubber type absorber (FAM1/FAM3/FAM6) and flexible sintered ferrite sheet (FAM7/FAM9). FAM is a well mixed material with one single layer design so the two sides are the same.

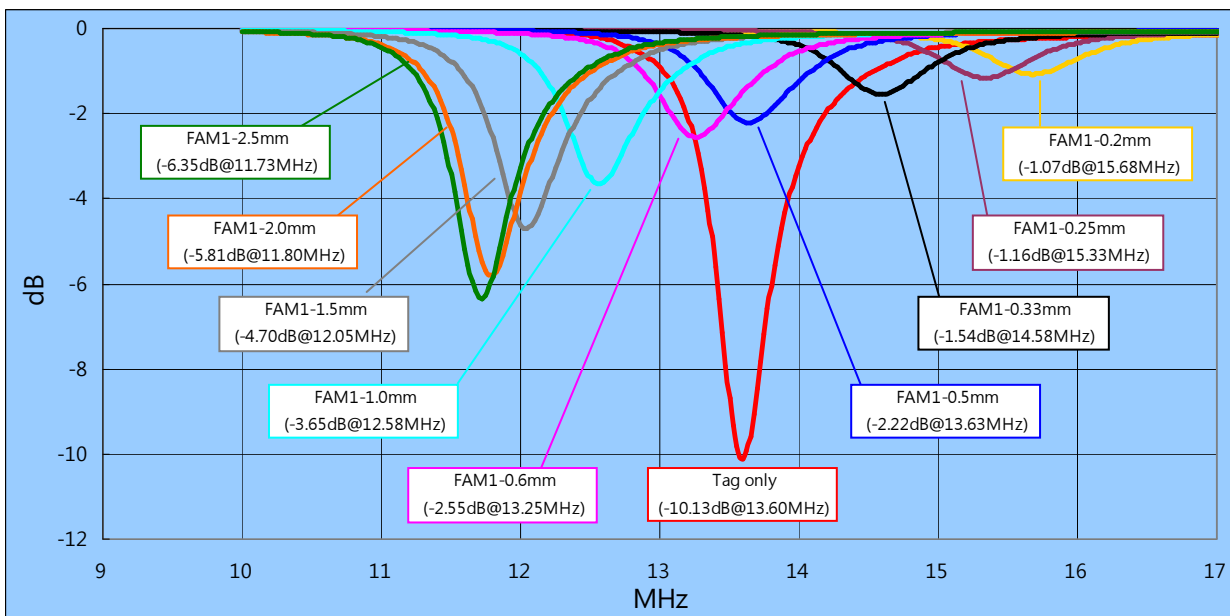
# Flexible Absorbent Material (FAM)

## The variation of response frequency when RFID tag + FAM + metal (Reference) :

1. The response frequency is become lower when FAM thickness become thick but the signal strength with little difference.










2. The response frequency is increase when metal attached, but the signal strength is smaller if FAM thickness is thinner. It means the metal affect more when FAM is thinner.

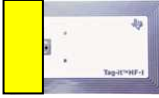




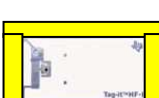



- The dimensions of FAM and metal are 85.6x54mm.
- The RFID tag is standard ISO card size (85.6x54mm) with HF TI 2048 chip.

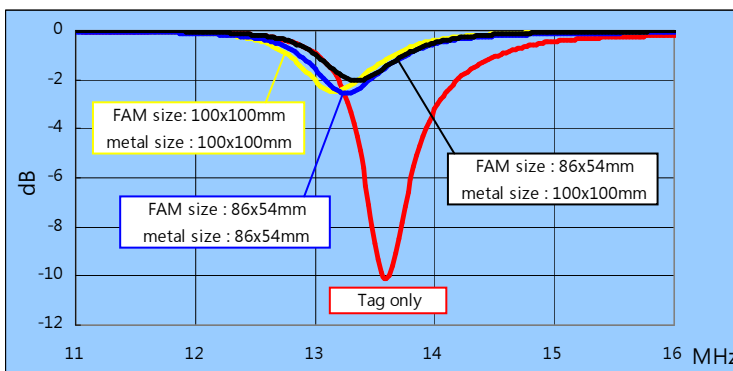
# Flexible Absorbent Material (FAM)

## Test Example for RFID Read Distance vs FAM dimension (Reference) :

FAM Location (yellow area)	FAM Dimension (mm)	Read Distance (%)
	85.6 x 54	100 %
	42.8 x 54 x 2pcs	100 %
	42.8 x 54 (left 1/2)	70 %
	42.8 x 54 (right 1/2)	70 %
	42.8 x 54 (middle)	70 %
	85.6 x 27 (up 1/2)	63 %
	85.6 x 27 (down 1/2)	63 %

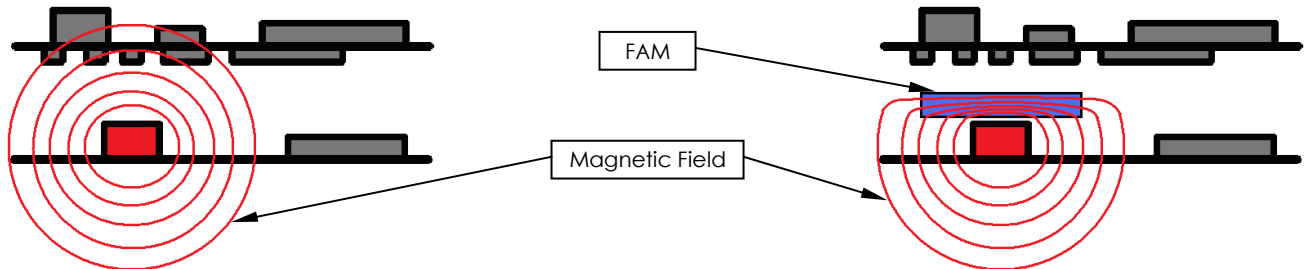
FAM Location (yellow area)	FAM Dimension (mm)	Read Distance (%)
	21.4 x 54 (left 1/4)	40 %
	21.4 x 54 (right 1/4)	40 %
	21.4 x 54 (middle)	40 %
	2.2 x 5.5 (center area)	0 %
	antenna area (up & down side)	45 %
	antenna area (all-around)	63 %
	antenna area (left and right side)	0 %

- The test inlay is used for 85.6x54mm standard ISO card with antenna size 76x45mm.
- Different reader, tag, metal material will cause different read distance.
- As upon test result, the longer read distance can be get if FAM size and antenna size are the same.
- If FAM or metal is bigger than antenna size, it will not cause read distance many different (as below figure).



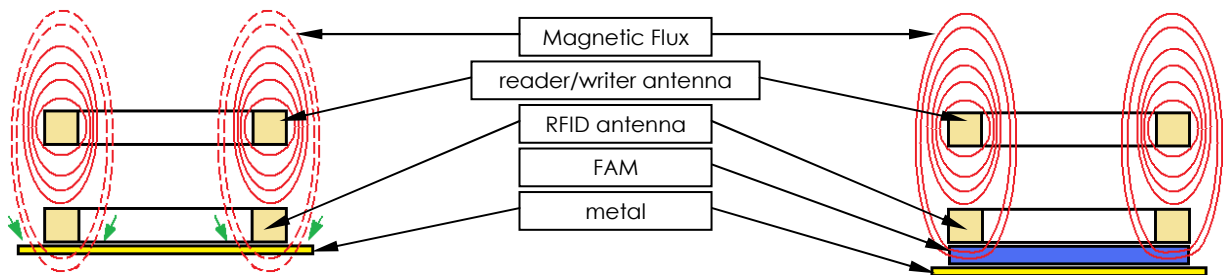
# Flexible Absorbent Material (FAM)

## Effect Diagram - Magnetic Shield :



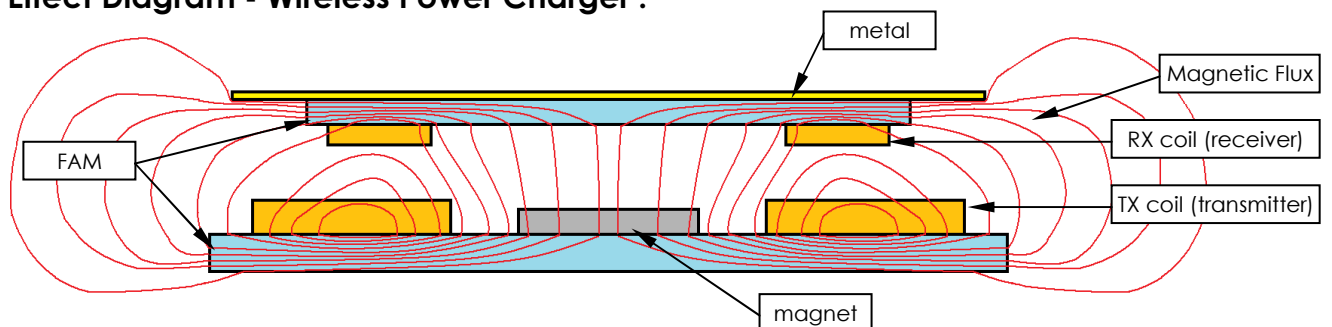
FAM can change the magnetic flux path to avoid the magnetic flux affect others components.

## Effect Diagram - RFID/NFC on metal :



The magnetic flux induced eddy current and generated a reverse magnetic field to offset the magnetic flux to cancel the communication. After attached FAM between metal and RFID antenna, the communication will recover.

## Effect Diagram - Wireless Power Charger :



FAM can be used for wireless power charger to avoid eddy current when RX coil attached on metal and change the magnetic flux path between TX coil, RX coil, magnet.

# Flexible Absorbent Material (FAM)

## Material List :

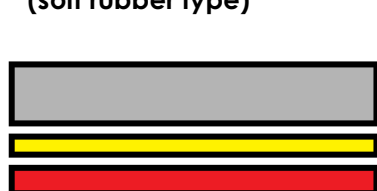
Property	Unit	FAM1	FAM3	FAM7
Operating Temperature	°C	-40 ~ +85		-30 ~ +120
Applicable Frequency	GHz	1MHz ~ 18GHz		1MHz ~ 3GHz
Permeability ( $\mu'$ @1MHz)	-	25	50	140
Material	-	Magnetic Powder + Rubber		Sintered Ferrite Sheet
Thickness Range	mm	0.12 ~ 2.50	0.25 ~ 2.50	0.12 / 0.22
Max. Dimension	mm	600 x 400		130 x 130
Surface Resistance	ohm	10 <sup>6</sup>		10 <sup>9</sup>
Density	g/cm <sup>3</sup>	3.6	4.8	3.8
RoHS 2.0 Compliance	-	2011/65/EU		2011/65/EU
Halogen-Free	-	No		Yes

Property	Unit	FAM6	FAM6B	FAM9
Operating Temperature	°C	-40 ~ +155		-30 ~ +120
Applicable Frequency	GHz	1MHz ~ 9GHz		1MHz ~ 3GHz
Permeability ( $\mu'$ @1MHz)	-	170	250	600
Material	-	Magnetic Powder + Rubber		Sintered Ferrite Sheet
Thickness Range	mm	0.05 ~ 0.50		0.22
Max. Dimension	mm	210x297 (A4 size)		130 x 130
Surface Resistance	ohm	10 <sup>6</sup>		10 <sup>9</sup>
Density	g/cm <sup>3</sup>	3.8		3.8
RoHS 2.0 Compliance	-	2011/65/EU		2011/65/EU
Halogen-Free	-	Yes		Yes

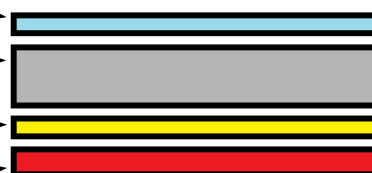
\* The property data for FAM1 / FAM3 / FAM6 are not include adhesive tape and release paper.

\* The property data for FAM7 / FAM9 are PET + Sintered Ferrite Sheet + adhesive tape (not include release paper).

### FAM 1/3/6 Structure : (soft rubber type)



### FAM 7/9 Structure : (flexible sintered ferrite sheet)



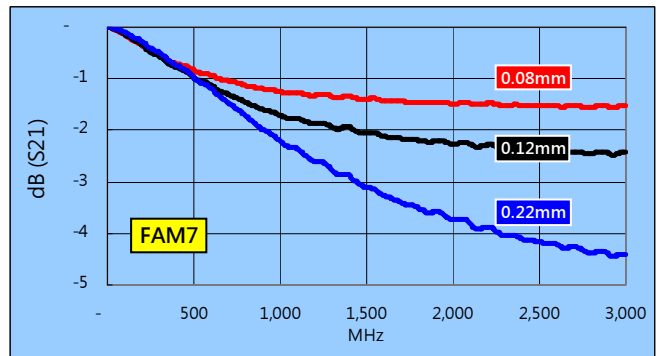
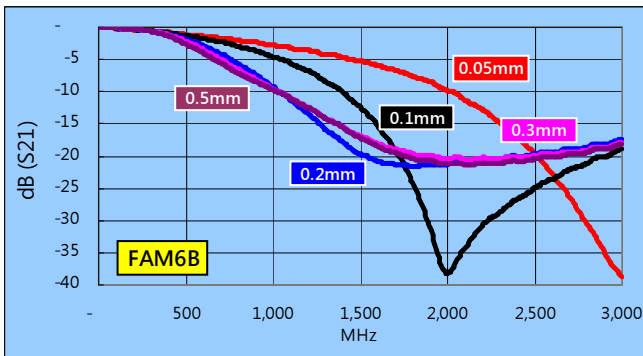
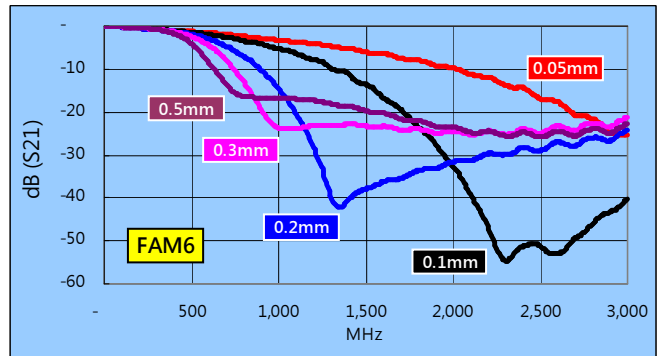
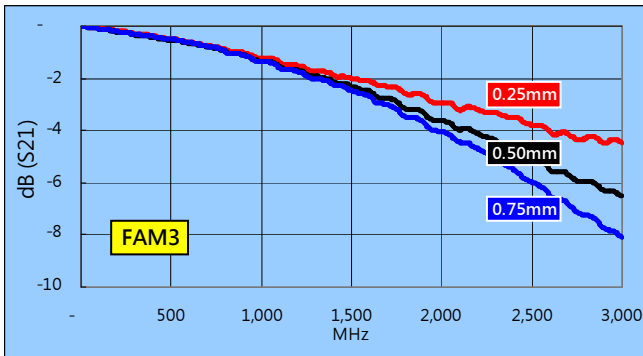
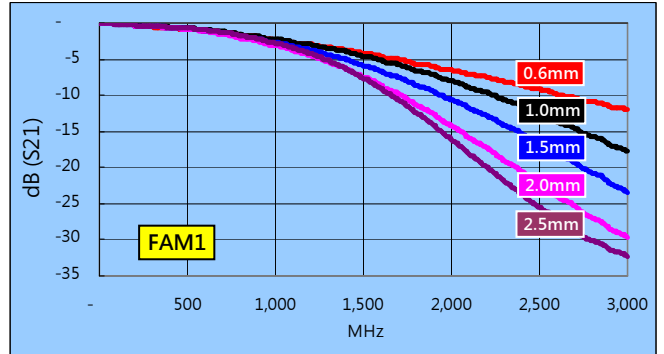
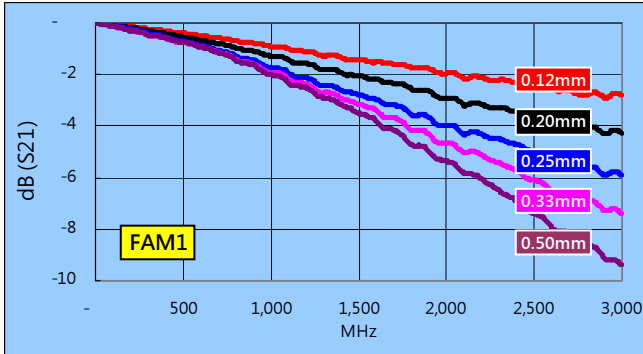
\* Allow none/one/two sides adhesive tape.

\* Allow one side PET and one side adhesive tape or two sides adhesive tape.

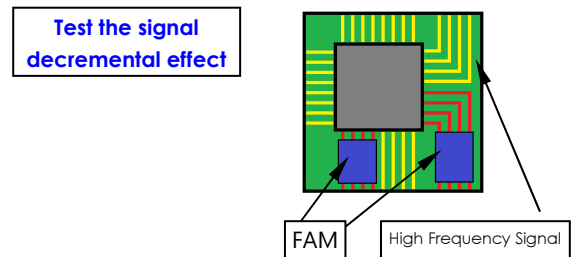
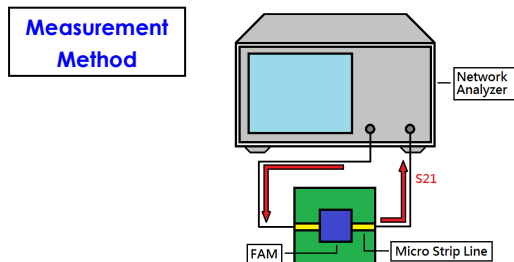


# Flexible Absorbent Material (FAM)

## Filter Effect Test :

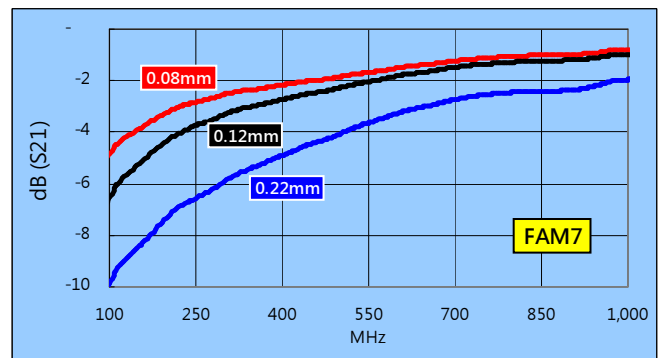
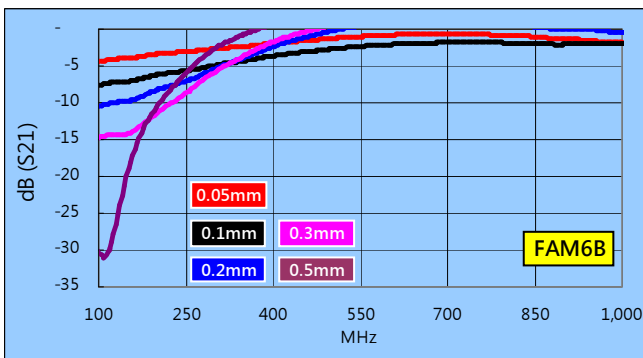
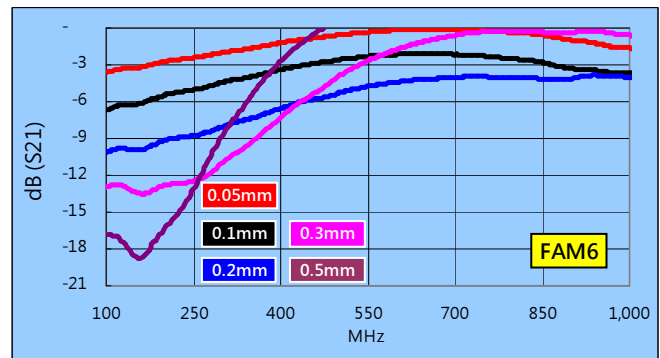
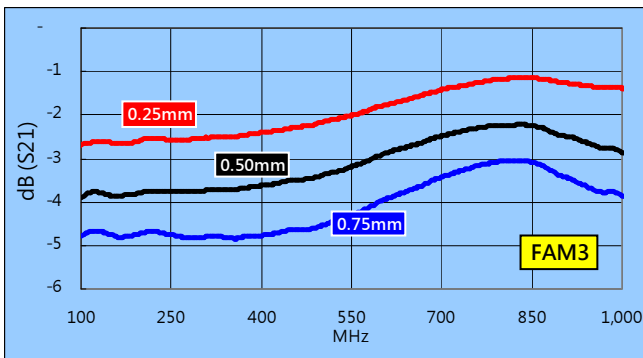
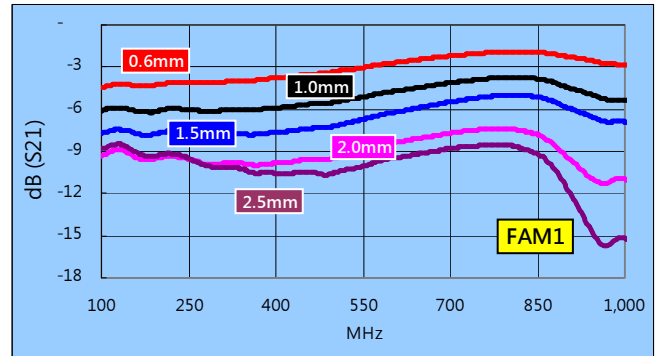
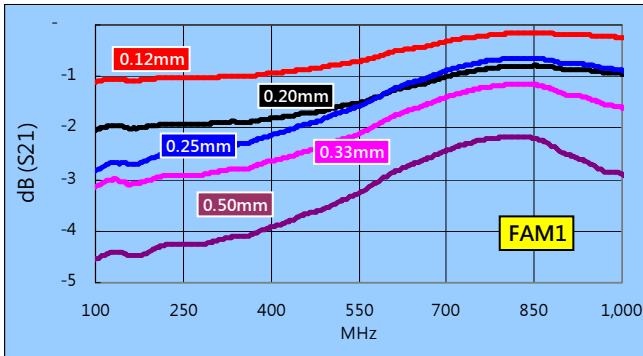


● Above test data is only for reference, not for specification data.

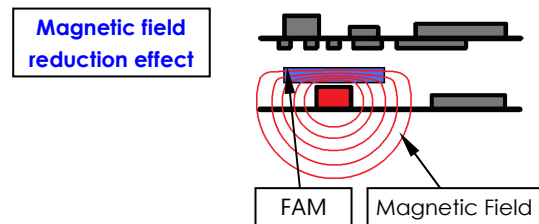
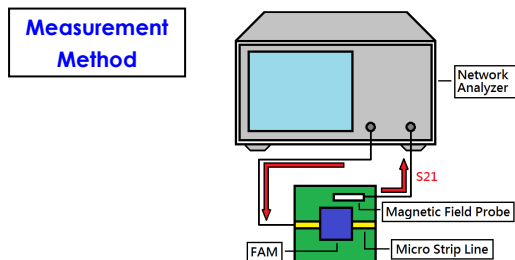


# Flexible Absorbent Material (FAM)

## Magnetic Shield / Decoupling Effect Test :

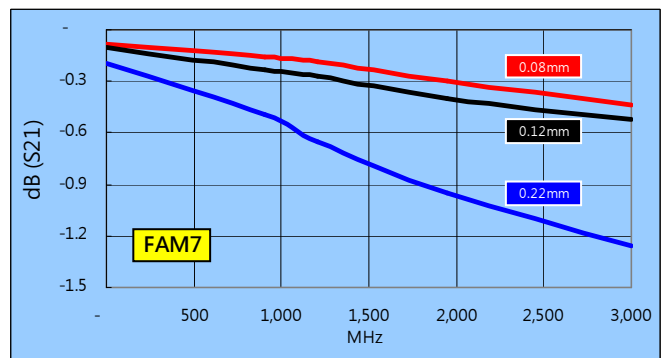
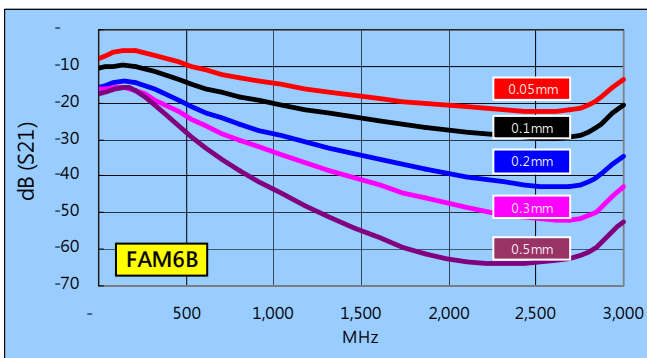
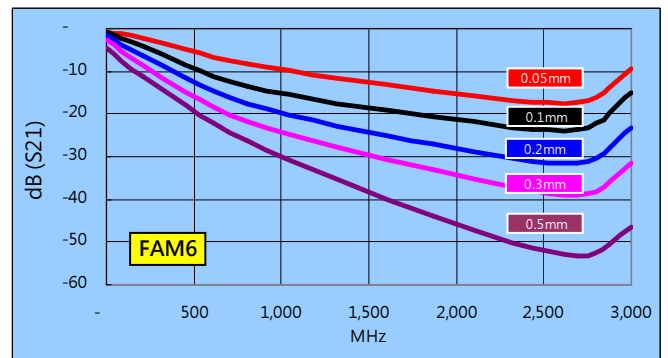
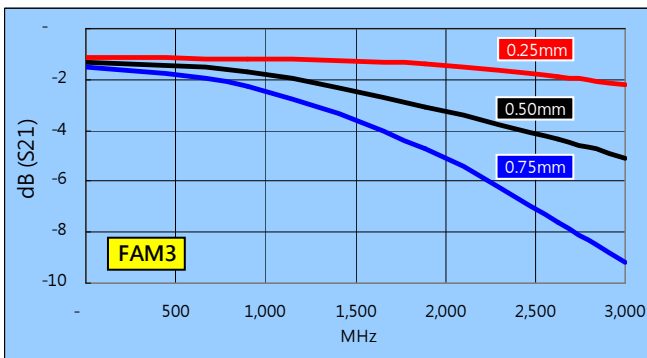
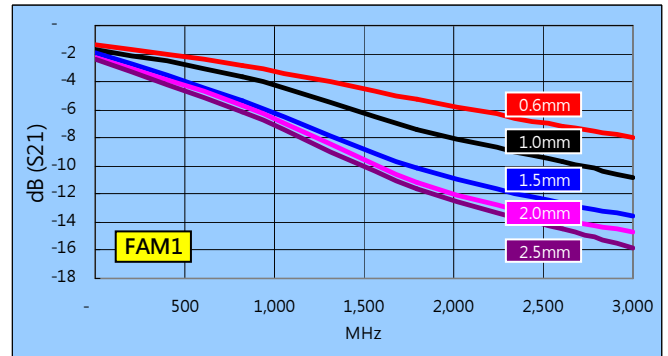
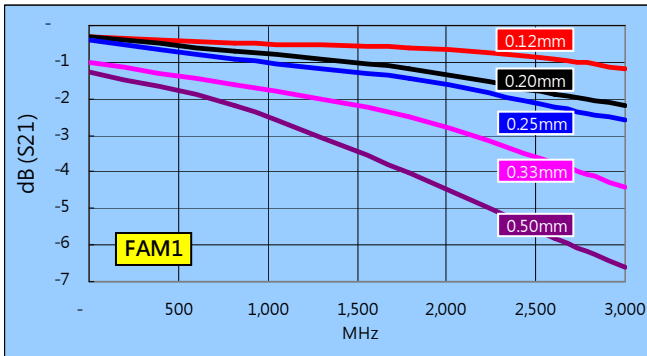


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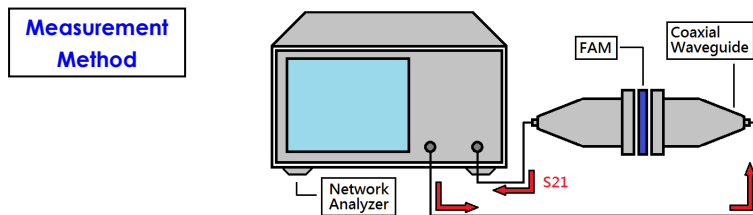


# Flexible Absorbent Material (FAM)

Insertion loss (1MHz ~ 3GHz) :

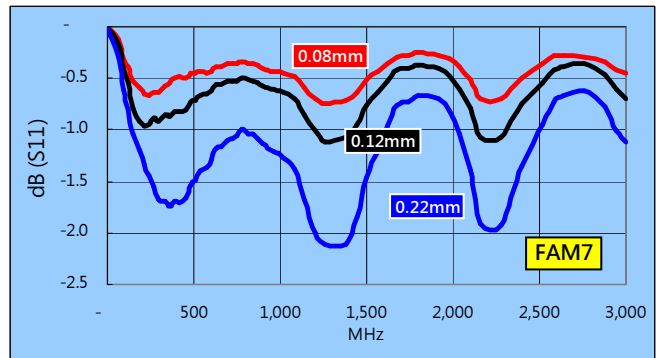
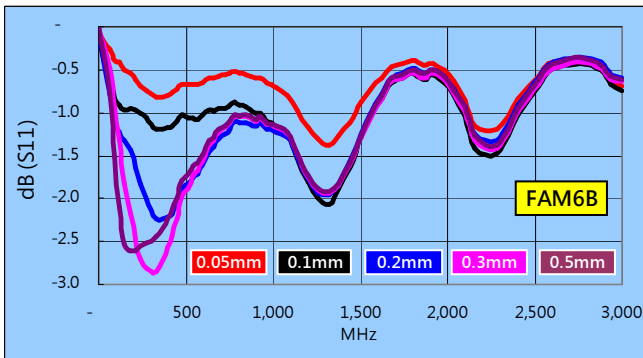
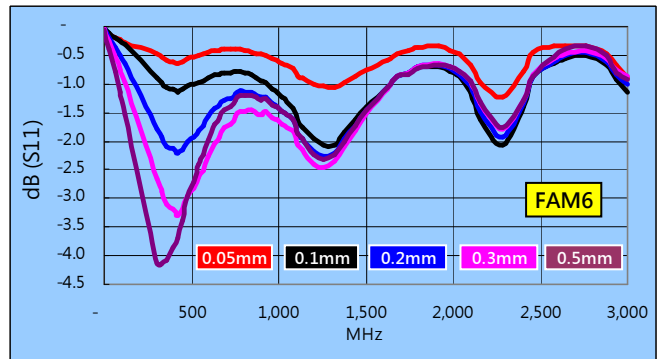
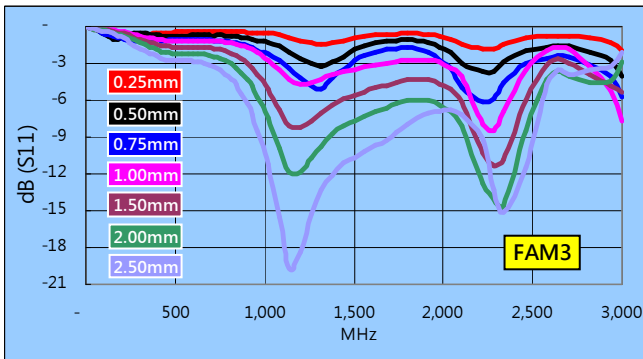
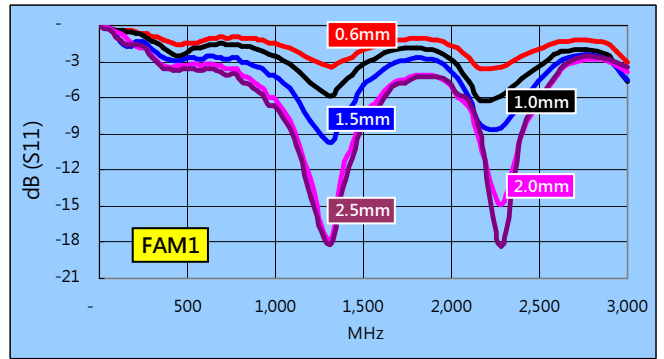
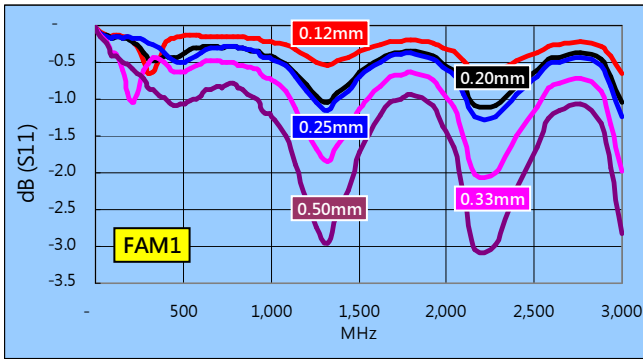


● Above test data is only for reference, not for specification data.

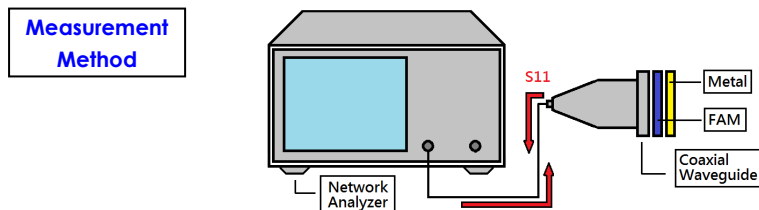


# Flexible Absorbent Material (FAM)

Return loss (1MHz ~ 3GHz) :

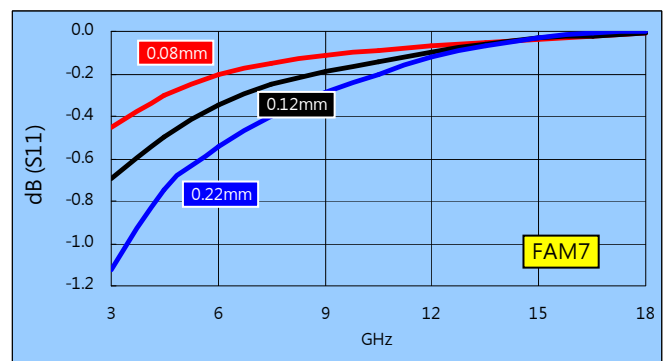
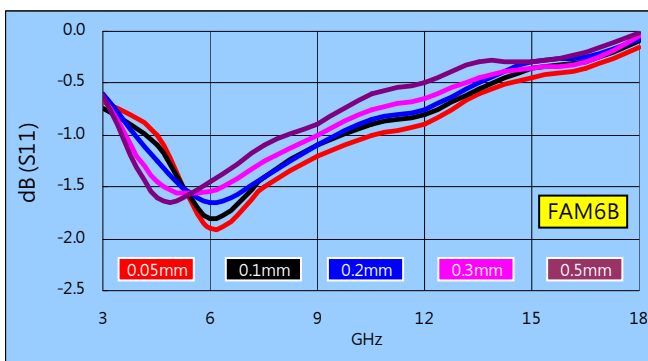
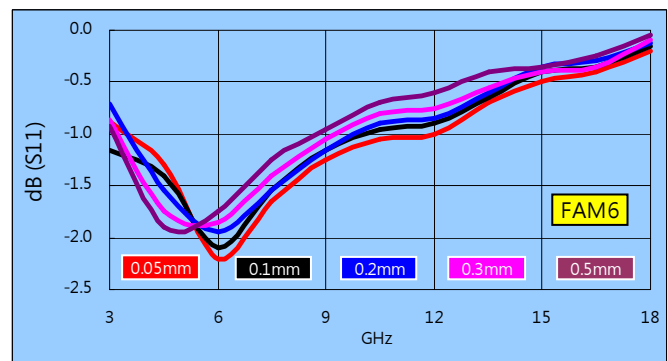
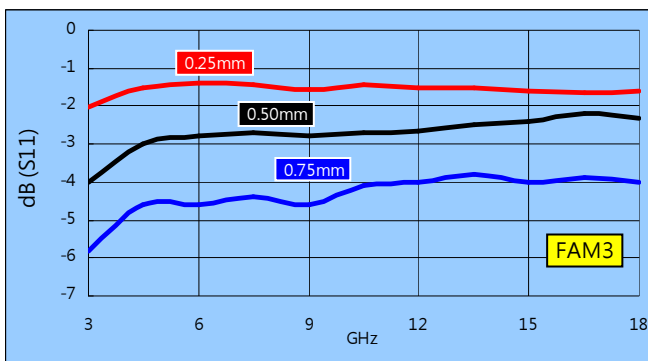
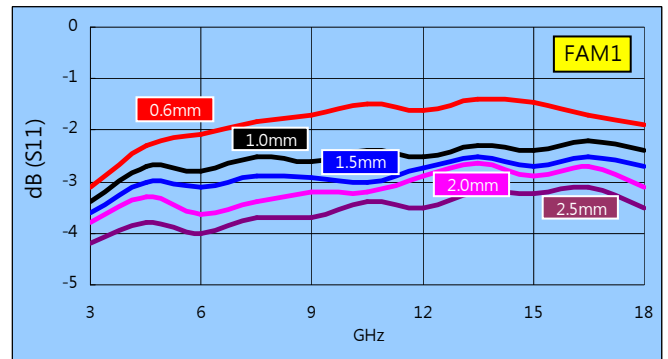
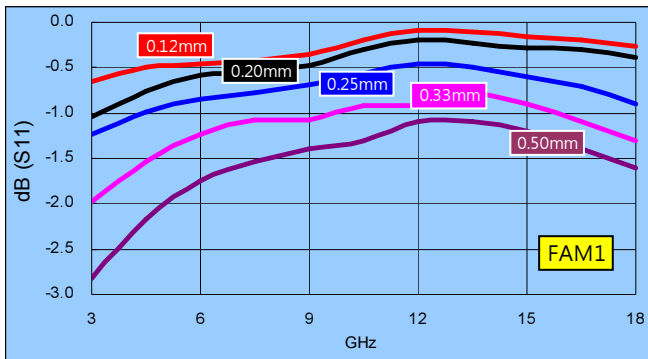


● Above test data is only for reference, not for specification data.

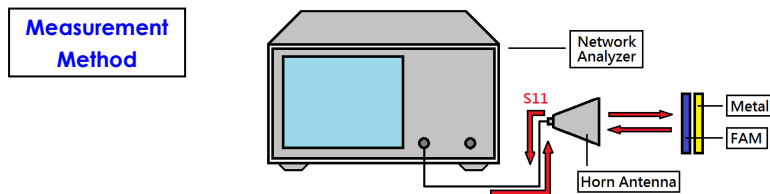


# Flexible Absorbent Material (FAM)

Return loss (3GHz ~ 18GHz) :

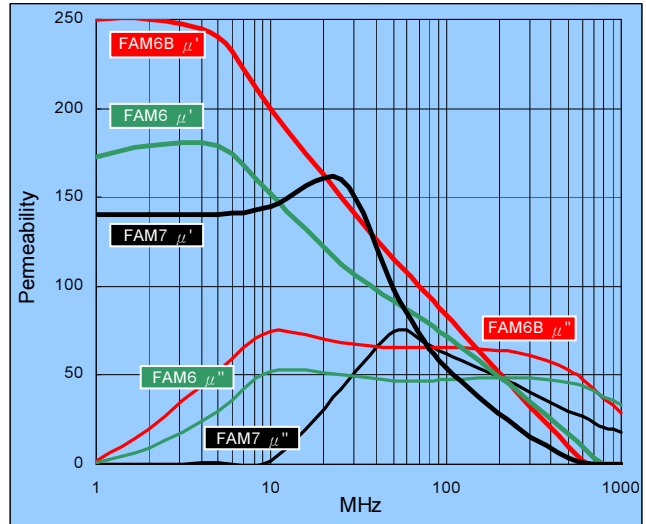
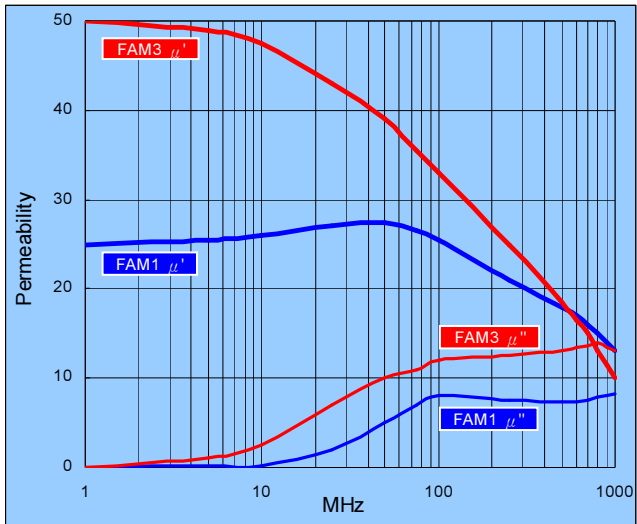


● Above test data is only for reference, not for specification data.



# Flexible Absorbent Material (FAM)

Permeability ( $\mu = \mu' - j\mu''$ ):



## How to choose FAM?

Item	FAM1	FAM3	FAM6	FAM6B	FAM7	FAM9
Price	Lowest	Low	Highest		High	
Best Application	RFID, NFC	EMI, RFID, NFC	EMI, RFID, NFC, Wireless Charger (no magnet type)			Wireless Charger (no magnet type)
Operation Temperature	-40 ~ +85 °C		-40 ~ +155 °C		-30 ~ +120 °C	
Applicable Frequency	1MHz ~ 18GHz		1MHz ~ 9GHz		1MHz ~ 3GHz	
Permeability ( $\mu'$ @1MHz)	25	50	170	250	140	600
Material	Magnetic Powder + Rubber				Sintered Ferrite Sheet	
Smallest Thickness	0.12 mm	0.25 mm	0.05 mm		0.12 mm	0.22 mm
Biggest Thickness	2.50 mm	2.50 mm	0.50 mm		0.22 mm	0.22 mm
Max. Dimension	600x400 mm		210x297 mm (A4 size)		130x130 mm	
Surface Resistance	10 <sup>6</sup>		10 <sup>6</sup>		10 <sup>9</sup>	
RoHS 2.0 Compliance	2011/65/EU		2011/65/EU		2011/65/EU	
Halogen-Free	No		Yes		Yes	